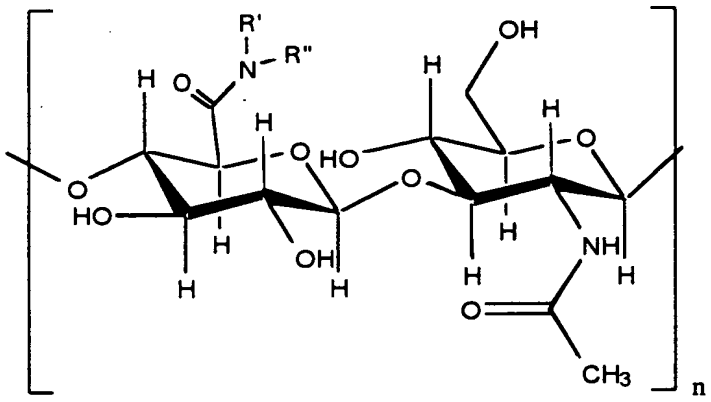
We claim:

1. A composition comprising a derivative of hyaluronic acid comprising disaccharide subunits, wherein at least one of said disaccharide subunits is a substituted disaccharide subunit having a substitution at a carboxyl group, such that the substituted disaccharide subunit is of the formula

(I)



wherein each of R' and R" is a side chain comprising one or more functional groups selected from the group consisting of hydrogen; bioactive peptide; alkyl; aryl; alkylaryl; arylalkyl, heterocycle, substituted alkylaryl containing an atom or atoms of oxygen, nitrogen, sulfur, or phosphorous; substituted arylalkyl containing an atom or atoms of oxygen, nitrogen, sulfur; phosphorous, halogen, or metal ion; and substituted heterocycle containing an atom or atoms of oxygen, nitrogen, sulfur; phosphorous, halogen, or metal ion; and

said side chain functional groups being bound directly to each other or separated by a member selected from the group consisting of ether, keto, amino, oxycarbonyl, sulfone, sulfoxide, carboxamide, alkyne, and alkene; and

said side chain terminating with a terminal functional group selected from the group consisting of hydrogen, peptide, aldehyde, amine, arylazide, hydrazide, maleimide, sulfhydryl, active ester, ester, carboxylate, imidoester, halogen, and hydroxyl.

2. The composition of claim 1, wherein at least 5% of said disaccharide subunits are substituted disaccharide subunits.

3. The composition of claim 1, wherein at most 95% of said disaccharide subunits are substituted disaccharide subunits.

4. The composition of claim 1, wherein at most 5% of said disaccharide subunits are substituted disaccharide subunits.

5. The composition of claim 1, wherein at least one of said terminal functional groups is selected from the group consisting of peptide, aldehyde, amine, arylazide, hydrazide, maleimide, sulfhydryl, and active ester, whereby said composition is amenable to crosslinking.

6. The composition of claim 1, wherein the molecular weight of said composition is at least 100,000 daltons.

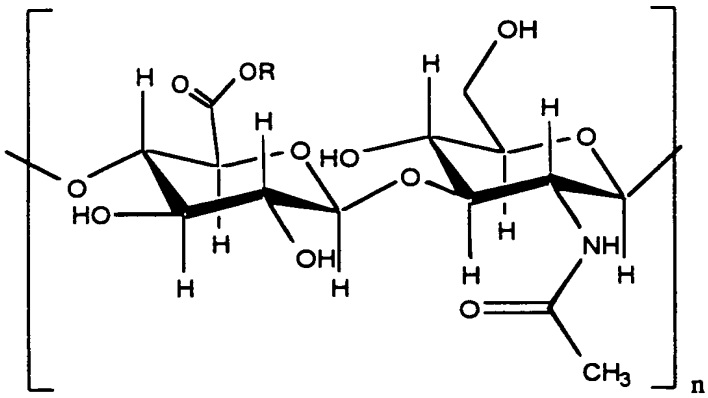
7. The composition of claim 1, wherein the molecular weight of said composition is at most 100,000 daltons.

8. The composition of claim 1, wherein the molecular weight of said composition is at least 1,000,000 daltons.

9. The composition of claim 1, wherein said composition is water soluble.

10. A composition comprising an activated ester of hyaluronic acid of the formula:

(II)



wherein R is selected from the group consisting of a substituted triazole, N-sulfosuccinimide, nitrophenol, partially halogenated phenol, perhalophenol, and pentafluorophenol.

11. A hydrogel of crosslinked HA derivatives, wherein said HA derivatives are compositions according to claim 1.

12. A hydrogel of crosslinked HA derivatives, wherein said HA derivatives are selected from the group consisting of the compositions of claim 10.

13. The hydrogel of crosslinked HA derivatives of claim 11, wherein said hydrogel is biodegradable.

14. A method for making a derivative of hyaluronic acid, comprising the steps of:

a) forming an activated ester at a carboxylate of a glucuronic acid moiety of hyaluronic acid; and

b) substituting, at the carbonyl carbon of the activated ester formed in step (a), a side chain comprising a nucleophilic portion and a functional group portion.

15. The method of claim 14, wherein the nucleophilic portion is selected from the group consisting of ammonia, primary amine, secondary amine, hydroxyl, and sulfhydryl.

16. The method of claim 14, wherein the functional group portion is selected from the group consisting of active ester, aldehyde, amine, arylazide, hydrazide, maleimide, sulfhydryl, and peptide.

17. The method of claim 14, wherein step (a) is performed with an active ester selected from the group consisting of a substituted triazole, N-sulfosuccinimide, nitrophenol, partially halogenated phenol, perhalophenol, pentafluorophenol, HOBT, and NHS, by carbodiimide-mediated coupling.

18. The method of claim 14, comprising the additional step of:

(c) forming a cross-linked hydrogel from the hyaluronic acid derivative.

19. A method for forming a matrix for a temporary scaffold for tissue repair according to the method of claim 18, wherein the crosslinker is selected from the group consisting of polyvalent active ester, aldehyde, amine, arylazide, maleimide, and sulfhydryl.

20. A method for forming a matrix for a temporary scaffold for tissue repair according to the method of claim 18, wherein the HA derivative comprises a peptide substrate for transglutaminase, and wherein the HA derivative is crosslinked using transglutaminase.

21. The method of claim 18, wherein step (c) is performed in the presence of cells.

22. The method of claim 18, wherein step (c) is performed in the presence of at least one member selected from the group consisting of growth factors, cytokines, drugs, and bioactive peptides.

23. The method of claim 22, wherein the bioactive peptide is RGD.

24. The method of claim 22, wherein the bioactive peptide is a substrate for transglutaminase.

25. The method of claim 24, wherein the bioactive peptide is APQQEA.

26. The method of claim 24, wherein the growth factor is TGF-β or BMP.

27. The method of claim 18, wherein step (c) is performed in situ in a patient in need of tissue repair.

28. A tissue adhesive comprising a hydrogel of claim 11, wherein the side chain is selected from the group consisting of activated ester, aldehyde, arylazide, and maleimide.

29. A tissue adhesive comprising an HA derivative of claim 10.

30. A tissue adhesive comprising a hydrogel of claim 11, wherein the crosslinked HA derivatives are formed using a cross-linker selected from the group consisting of polyvalent active ester, aldehyde, arylazide, and maleimide.

31. A tissue adhesive comprising a hydrogel of claim 11, wherein the cross-linked hydrogel is formed in the presence of at least one member selected from the group consisting of growth factors, cytokines, drugs, and bioactive peptides.

32. A tissue adhesive of claim 31, wherein the growth factor is TGF-β or BMP-2.

33. A matrix for cell cultures comprising a hydrogel of claim 11, wherein the crosslinked HA-derivatives are formed using a cross-linker selected from the group consisting of polyvalent active ester, aldehyde, amine, arylazide, maleimide, and sulfhydryl.

34. A matrix for cell cultures comprising a hydrogel of claim 11, wherein the crosslinked hydrogel is formed in the presence of at least one member selected from the group consisting of growth factors, cytokines, drugs, and bioactive peptides.

35. A matrix for cell cultures according to claim 34, wherein the growth factor is TGF-β or BMP-2.

36. A matrix for a scaffold comprising a hydrogel of claim 11, wherein the crosslinked HA-derivatives are formed using a cross-linker selected from the group consisting of polyvalent active ester, aldehyde, amine, arylazide, maleimide, and sulfhydryl.

37. A matrix for a scaffold comprising a hydrogel of claim 11, wherein the crosslinked hydrogel is formed in the presence of at least one member selected from the group consisting of growth factors, cytokines, drugs, and bioactive peptides.

38. A matrix for a scaffold according to claim 37, wherein the growth factor is TGF-β or BMP-2.

39. The matrix of claim 37, wherein the matrix further comprises cells.